higher education & training

Department:
Higher Education and Training
REPUBLIC OF SOUTH AFRICA

NATIONAL CERTIFICATE

RADIO AND TELEVISION THEORY N2

(11040832)

16 April 2021 (X-paper)
09:00–12:00

Nonprogrammable calculators and drawing instruments may be used.

This question paper consists of 5 pages and a formula sheet of 2 pages.

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DEPARTMENT OF HIGHER EDUCATION AND TRAINING
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NATIONAL CERTIFICATE
RADIO AND TELEVISION THEORY N2
TIME: 3 HOURS
MARKS: 100

INSTRUCTIONS AND INFORMATION

1. Answer all the questions.
2. Read all the questions carefully.
3. Number the answers according to the numbering system used in this question paper.
4. Only use a black or blue pen.
5. Write neatly and legibly.

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QUESTION 1

Indicate whether the following statements are TRUE or FALSE by writing only 'True' or 'False' next to the question number (1.1–1.15) in the ANSWER BOOK.

1.1 The area of the plates of a capacitor does not affect the amount of charge stored by the capacitor.

1.2 The time constant of an RC circuit can be defined as the time it takes to charge a capacitor to 36,8% of the maximum applied voltage.

1.3 Period is the time taken for one complete cycle.

1.4 In a purely capacitive circuit, the current lags the voltage by 90°.

1.5 When the applied frequency of an R, L, C circuit increases, the inductive reactance also increases proportionately.

1.6 In a series resonant circuit containing R, L and C, $V_L = V_C$.

1.7 The output signal of the common base amplifier is in phase with the input signal.

1.8 In radio wave communication the information transmitted is in the form of an electromagnetic wave.

1.9 The local oscillator in a radio receiver generates a variable frequency signal at a constant amplitude.

1.10 The Hartley oscillator uses tapped inductance for the feedback circuit.

1.11 For an amplifier to operate as a class-A amplifier the working point is selected to operate in the cut-off region.

1.12 A band stop filter attenuates a certain band of frequencies.

1.13 The EHT in a monochrome television receiver is equal to that found in a colour television receiver.

1.14 The time-base generator found in C.R.O. generates a saw-tooth waveform.

1.15 An ammeter must always be connected in series with the load.

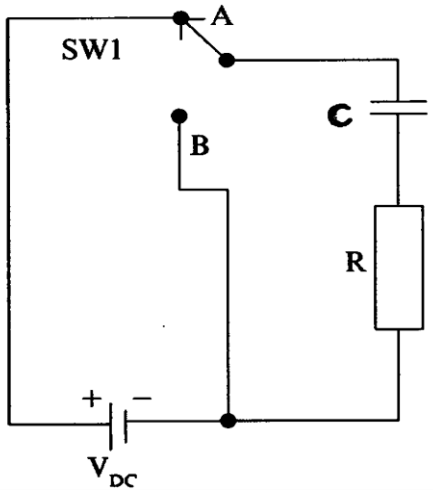
(15 × 1) **[15]**

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QUESTION 2

For the circuit shown below, draw two comparative graphs on the same system of axis when switch SW1 is on position A for 5 time constants and then switched to position B.

Draw the voltage on the y-axis and the time on the x-axis.



[8]

QUESTION 3

3.1 Give FOUR conditions that exist when a circuit with R, L and C in parallel, resonates. (4)

3.2 A series R, L, C circuit consists of R=500 Ω; L=10 mH and C=10 nF. The supply frequency is 12kHz with a supply voltage of 20 V.

Calculate:

3.2.1 The total current flowing. (9)

3.2.2 The voltage drop across C, R and L. (6)

[19]

QUESTION 4

Complete the missing information from the table below. Write the answer next to the letter (A–K) in the ANSWER BOOK.

	COMMON EMITTER	COMMON BASE	COMMON COLLECTOR
Current gain	High	A	B
Voltage gain	C	High	D
Power gain	High	E	F
Input impedance	G	Low	H
Output impedance	Medium	I	Low
Phase shift	J	K	0°

[11]

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QUESTION 5

5.1 Draw a frequency spectrum chart of a modulated signal where the carrier frequency of 10kHz has been modulated by an audio frequency of 300Hz to 3000Hz. (10)

5.2 State the intermediate frequency for FM and AM receivers. (2)

[12]

QUESTION 6

Draw a neat, fully labelled block diagram of a 625-line colour television receiver. Indicate all signal directions and interconnections. **[18]**

QUESTION 7

Name the seven main sub-sections of an oscilloscope. **[7]**

QUESTION 8

Before proceeding with a fault finding process, one needs to prepare for this process. State and briefly explain TEN procedures one would apply before proceeding with the process. **[10]**

TOTAL: 100

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FORMULA SHEET

CAPACITOR CALCULATIONS

Capacitors in series: $\frac{1}{C_T} = \frac{1}{C_1} + \frac{1}{C_2} + \ldots$

Capacitors in parallel: $C_T = C_1 + C_2 + \ldots$

Instantaneous voltage across a capacitor: $V_c = V\left(1 - e^{\frac{-t}{RC}}\right)$

Initial charging current through a capacitor: $i = \frac{V}{R} \times e^{\frac{-t}{RC}}$

Time constant: $T = R \times C$

Charge of capacitor: $Q = C \times V$

AC THEORY

Inductive reactance: $X_L = 2.\pi.F.L$

Capacitive reactance: $X_c = \frac{1}{2.\pi.F.C}$

Impedance for RL, RC and RLC circuits:

$Z = \sqrt{R^2 + X_L^2}$ $Z = \sqrt{R^2 + X_C^2}$ $Z = \sqrt{R^2 + (X_L \simeq X_c)^2}$

Circuit current for RL, RC and RLC circuits:

$I_T = \frac{V}{X_L}$ $I_T = \frac{V}{X_C}$ $I_T = \frac{V}{Z}$

Voltage drop across components:

$V_R = I \times R$ $V_L = I \times X_L$ $V_C = I \times X_C$

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Power factor: $Cos\,\theta = \frac{R}{Z}$

Phase angle: $\phi = Cos^{-1}\frac{R}{Z}$

Resonant frequency: $f_r = \frac{1}{2.\pi.\sqrt{L.C}}$

Q-factor: $Q = \frac{1}{R}.\sqrt{\frac{L}{C}}$

OHM'S LAW

Resistors in series: $R_T = R_1 + R_2 + ...$

Resistors in parallel: $\frac{1}{R_T} = \frac{1}{R_1} + \frac{1}{R_2} + ...$

Voltage drop: $V = I \times R$

Circuit current: $I = \frac{V}{R}$

OSCILLOSCOPE CALCULATIONS

Period = Time/Division × Horizontal divisions

Amplitude = Volts/Division × Vertical divisions

Frequency = $\frac{1}{Period}$

RMS voltage = 0,707 × Peak

Average voltage = 0,637 × Peak

Voltage (Peak-to-peak) = 2 × Peak

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